THE dissertation for which Mr. H. N. Dickson has received the B.Sc. research degree of Oxford University was "On the circulation of the surface waters of the Atlantic north of 40° N. lat." The work consisted primarily of a chemical and physical examination of the surface waters of the North Atlantic during the twenty-four successive months of the years 1896 and 1897. For the purpose of the investigations special arrangements were made for the continuous supply of samples by officers of ships trading in the North Atlantic. The results were exhibited in monthly charts showing the distribution of temperature and salinity, and the changes during the period are fully discussed. The existence of definite seasonal changes in the circulation has been established by the investigation.

WITH a view to encourage the adoption of scientific methods in the teaching of physical geography, the authorities of the Cambridge Local Examinations have issued a syllabus of a course of work which has several commendable characteristics. In the first place, it is distinctly stated at the head of the syllabus that "The object of the examination will be to ascertain as far as possible to what extent the candidates' powers of observation and reasoning have been cultivated." Even more noteworthy than this remark is the schedule which accompanies the syllabus and contains an outline of a course of practical instruction designed "(1) to develop the power and habit of observation; (2) to give the pupils clear and accurate conceptions of natural phenomena and their relations; and (3) to enable them to seek for the causes and rational explanations of the phenomena which they observe." Among the subjects in which practical instruction is to be given are: the drawing of sections from contour maps, the study of local land-forms, the use of meteorological instruments, the study of ocean current maps, simple astronomical observations, the determination of time and latitude, and the use of the terrestrial globe. It is to be hoped that the efforts of the Cambridge authorities to encourage the scientific study of the earth will meet with success. No subject stands in greater need of rational methods of instruction than geography.

THE English Education Exhibition, which was opened by H.R.H. the Prince of Wales at the Imperial Institute on Friday last, contains the materials from which the English educational exhibits for the Paris Exhibition will be chosen. The whole field of educational activity in this country is more or less satisfactorily represented by these exhibits, though a walk through the galleries shows the initiated observer how impossible it is to materialise certain factors of educational effort, which though intangible are none the less real and powerful. Every step in a career from the kindergarten to the university can be followed by the inspection of the objects collected in the different sections. It is satisfactory to be able to record that the equipment necessary for proper instruction in science takes a prominent place in the collections sent by nearly all the elementary schools, most of the secondary schools, the technical institutes, and the colleges of university rank. Hand and eye training is evidently now almost universal, for one exhibit after the other contains admirable examples of wood-work, metal-work, clay-modelling, and miscellaneous occupations of a varied kind having the same end in view. We noticed with some satisfaction an etching of Charles Darwin in the Shrewsbury School exhibit; even if he received little encouragement in science at the school, it is quite clear the authorities are proud of him.

SCIENTIFIC SERIALS.

Wiedemann's Annalen der Physik und Chemie, No. 12.—Magnetic deflection of kathode rays, by E. Wiechert. The velocity of kathode rays is determined by deflecting them at two different points of their path by currents of a Lecher wire system slightly retarded with respect to each other. The velocity comes out as about one-seventh of that of light, and the mass transported with each electron is about 1/1300 part of an oxygen atom.—Relation between electric conductivity and pressure, by G. Tammann. Gaseous ionisation is reduced by increase of pressure, while the ionisation of a solution is increased. In incompletely dissociated solutions, an increase of conductivity with pressure is observed. Thus, a deci-normal solution of acetic acid is reduced in resistance to one-half its original value by a pressure of 2500 atmospheres.—An experimental and theoretical fallacy in electrical doctrine, by E. Lecher. The author maintains that a magnetic line of force can in no sense be defined as a line along which a positive pole would move, and that as a matter of fact a pole never moves along a line of force.—Distribution of free electricity at the surface of a Crookes' tube, by E. Riecke. The author uses a mixture of red lead and sulphur to discover the free charges on the outer surface. The fluorescent patch is marked by a wide ring of sulphur, the interior of which is marked by irregular patches of red lead, showing negative charges distributed irregularly, probably owing to want of symmetry in the kathode. The remainder of the tube is coated with sulphur, except the portion behind the kathode, which is negative again.—Strains in Rupert's drops, by K. Mack. Rupert's drops show black on the screen in polarised light, but they can be made to show their colours by immersing them in a trough containing a liquid of the same refractive index, such as cedar oil or a mixture of carbon bisulphide and ethyl ether. The colours resemble those of peacock's feathers.—Magnetic deflection of Becquerel rays, by F. Giesel. The deflection may be demonstrated by means of a polonium preparation attached to a sensitive plate laid face downwards across the poles of an electro-magnet. The deflected rays on the negative show a curious hairy structure.—The photography of current curves, by J. Zenneck. Instead of using a sliding plate or a revolving mirror with the Braun kathode tube, the author produces the current curve direct upon the screen in the kathode tube.—He uses two deflecting magnets, one for producing the oscillation due to the current under investigation, and the other for imparting to the kathode beam a lateral movement proportional to the time.

Memoirs of the Novorossian (Odessa) Society of Naturalists, vol. xxii. Part 2.—The whole of this volume is given to the results of the exploration of the *liman* (salt lake) of Kuyalnik, situated near Odessa, which exploration was undertaken several years ago by the Odessa University. Most of the volume is occupied by a most exhaustive report, by A. Wassilieff, about the astronomical, topographical and bathymetric work made in connection with this liman. A large scale map (1 : 16, 800) of the lake and several vertical profiles accompany the report, which will be a precious document for all subsequent exploration.—The rest of the volume is taken up by a paper, by L. Silberberger and M. Weinberg, on the bacteria found in the mud of the liman. They originate partly from the surrounding air and partly from the waters entering the lake, their composition varying with the seasons. The mud is not favourable for the life of the bacteria, which add to the mud by their decay.

IN the *Journal of Botany* for December 1899, the most important article is by Dr. A. B. Rendle, Notes on *Xyris*, in which several new species are described.—Messrs. J. A. Wheldon and Albert Wilson conclude their paper on the mosses of West Lancashire. In the number for January 1900 we find papers on *Sphagnum medium* in Britain, by Mr. H. W. Monington (with a plate).—Some Welsh hawkweeds, by the Rev. Augustin Ley, in which one more is added to the long list of British "species" of *Hieracium*.—On some species of *Cracca*, by Messrs. Jas. Britten and E. G. Baker.

THE *Journal of the Royal Microscopical Society* for December 1899 contains a continuation of Mr. F. W. Millett's paper on recent Foraminifera of the Malay Archipelago, and the usual summary of current researches in zoology, botany and microscopy. In the latter section several valuable recent novelties in microscopic construction are described. This number also contains the list for 1899 of new terms introduced during the year in zoological and botanical literature.

SOCIETIES AND ACADEMIES.

LONDON.

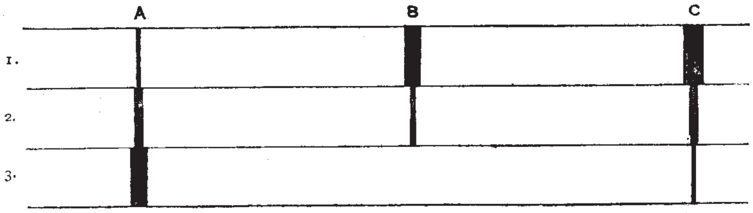
Royal Society, November 23, 1899.—"Note on the Spectrum of Silicium." By Sir Norman Lockyer, K.C.B., F.R.S.

The recent observations show that the lines of silicium may be divided into three sets, no two of which behave alike under varying electrical conditions. The wave-lengths of the lines composing the different sets are:—

$$\left.\begin{array}{l}3856\cdot1\\3862\cdot7\\4128\cdot1\\4131\cdot1\end{array}\right\}\text{A.}\qquad\qquad\left.\begin{array}{l}4089\cdot1\\4116\cdot4\end{array}\right\}\text{B.}\qquad\qquad\left.\begin{array}{l}4552\cdot8\\4568\cdot0\\4575\cdot3\end{array}\right\}\text{C.}$$

There is a line at λ 3905·8 which is associated in the spark spectrum of silicium with the lines in set A, but while these are entirely absent from the arc spectrum of silicium, 3905·8 is a strong line in the arc spectrum. This line differs from the others, therefore, in not being enhanced in intensity in passing from the conditions of the arc to those of the spark. So far as is known, the lines in sets B and C have not been recorded by any other observers of the silicium spectrum.

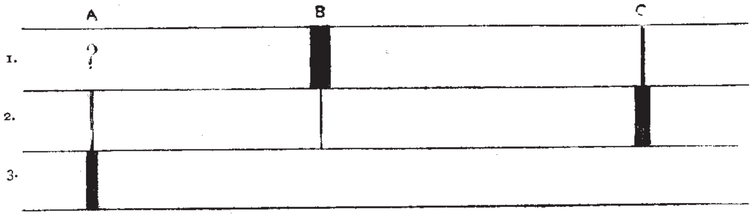
The behaviour of the three sets of lines in terrestrial spectra is shown in the following figure :—



1. SiF_4 vacuum tube (capillary). 2. SiO_2 spark with Spottiswoode coil. 3. Vacuum tube (bulb) SiO_2 spark with small coil.

It is found, on investigating the occurrence of these silicium lines in stellar spectra, that the three sets of lines respectively attain a maximum intensity at the three different levels of stellar temperature represented by β, γ, and ζ Orionis.

The accompanying figure shows the behaviour of the different sets A, B, and C in the spectra β, γ, ζ Orionis.



1. ζ Orionis. 2. γ Orionis. 3. β Orionis.

We find that set A is most prominent in the spectrum of β Orionis, that set C predominates in the spectrum of γ Orionis, and that set B is by far the strongest in that of ζ Orionis.

That the stars named represent three different grades of temperature, ζ Orionis being the hottest, and β Orionis the coolest, has been previously deduced by the discussion of other lines in their spectra. This result was embodied in a paper "On the Order of Appearance of Chemical Substances at different Stellar Temperatures," read to the Society in February, 1899. In that paper α Crucis was given as a typical star representing a stage of temperature between those of β Orionis and ζ Orionis. That star can be very well replaced for the purpose of the present discussion by γ Orionis, the two spectra being nearly identical.

It was recently shown that silicium made its appearance first at the temperature represented by α Ursæ Minoris, and strengthened at the higher temperature of α Cygni and β Orionis, afterwards weakening as we pass through the still higher temperatures of ζ Tauri and γ Orionis, until at the ζ Orionis stage it is bordering on extinction.

In the same paper the behaviour of a line at λ 4089·2 was plotted, and at the same time it was quoted as an "unknown" line.

It is interesting to note that this line is now traced to silicium, and is the strongest line in set B. It is apparently a short-lived line in stellar spectra, as it only occurs between the stages of temperature represented by γ Orionis and ζ Orionis, being one of the weakest lines in the spectrum of the former star, and one of the strongest in that of the latter.

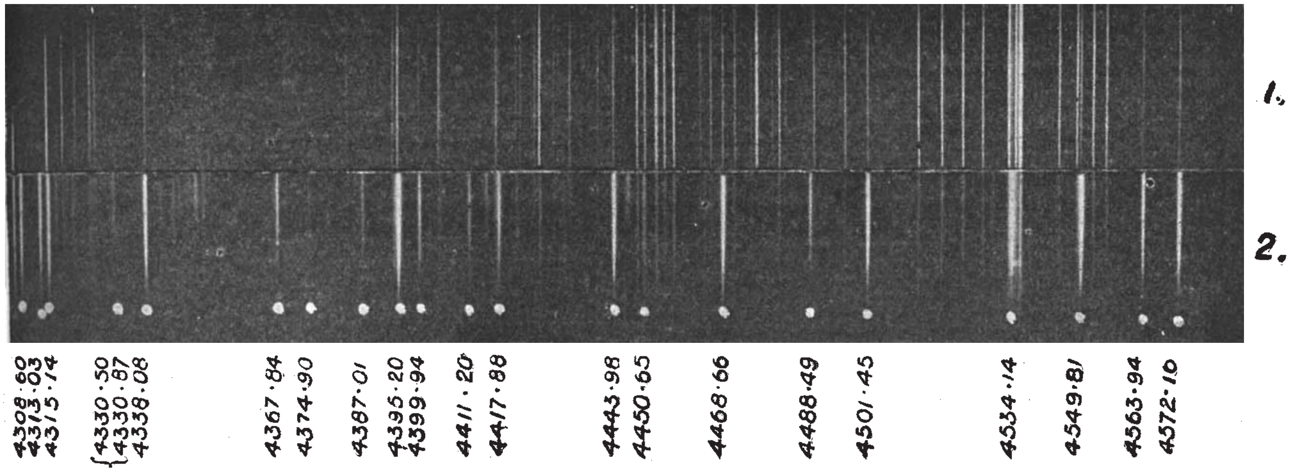
November 23, 1899.—"Preliminary Table of Wave-lengths of Enhanced Lines." By Sir Norman Lockyer, K.C.B., F.R.S.

The important part which the enhanced lines of the element play in the study of stellar spectra cannot be over-estimated, but a great advance can only be made in this direction by a systematic examination of the spectra of all the elements. Such an undertaking as this involves considerable time and labour. The author has been fortunate enough to have the use of the large 42-inch Spottiswoode coil, made by Apps, for a short space of time, and employed it in this work, for which it is specially adapted, as the brilliancy of its spark shortens the time of exposure.

The elements which have been dealt with in this investigation are the following :—"Aluminium, bismuth, chromium, copper, iron, magnesium, manganese, titanium, and vanadium."

For each of these elements the spark and arc spectra were photographed and compared, and the wave-lengths of the enhanced lines, that is, those lines which are intensified in passing from the temperature of the electric arc to that of the spark, were determined, and tables are given of their wave-lengths.

An illustration shows the enhanced and arc lines in the spectrum of titanium.



Titanium.—Enhanced Lines.
1. Arc. 2. Spark.

Chemical Society, December 21, 1899.—Prof. Thorpe, President, in the chair.—The following papers were read:—On the refractive and magnetic rotatory powers of some aromatic hydrocarbons, and on the refractive powers of mixtures, by W. H. Perkin, senr. The replacement of hydrogen in an aromatic nucleus by methyl is accompanied by a greater increase in molecular refraction, and a smaller increase in magnetic rotation, than is the replacement of hydrogen in a side chain by a methyl group.—Formation of α- and β- acrose from glycollic aldehyde, by H. Jackson. Tetrosazone and α- and β- acrosazone are obtained from the condensation product formed by the action of soda on a dilute glycollic aldehyde solution at 0°; on prolonged condensation at 0°, the quantity of tetrosazone obtainable decreases.—The interaction of mercurous nitrite and ethyl iodide, by P. C. Rây. Mercurous nitrite and ethylic iodide react to form nitroethane and ethylic nitrite.—On mercurous nitrite, by P. C. Rây.—The action of alkyl iodides on the mercuric iodide sulphides of the fatty series, by S. Smiles. The alkylic sulphides combine with mercuric iodide to form compounds of the type R_2SHgI_2 containing tetrad sulphur; these substances when treated with methylic iodide yield compounds of the type R_3SIHgI_2 which possibly contain hexad sulphur.—On brasilin and hæmatoxylin, Part III., by A. W. Gilbody and W. H. Perkin, junr. The acid $C_{15}H_{16}O_6$ previously obtained from brasalin yields metahemipinic acid on oxidation; the latter acid is also formed during the oxidation of tetramethylhæmatoxylin. It is shown that brasilin is a derivative of resorcinol and catechol, whilst hæmatoxylin is a derivative of pyrogallol and catechol.—The action of alcoholic potash on monobromoglutaric ester, by N. E. Bowtell and W. H. Perkin, junr. Monobromoglutaric ester is converted by alcoholic potash into transtrimethylenedicarboxylic acid.—Luteolin, III., by A. G. Perkin.—The action of chloroform and potassium hydroxide on orthoamidobenzoic acid, by W. J. Elliott. Orthoamidobenzoic acid yields an aldehydoorthoamidobenzoic acid on treatment with chloroform and potash.—Azo- and hydrazone compounds differentiated by bromine, by H. E. Armstrong.

Linnean Society, Dec. 21, 1899.—Dr. A. Günther, F.R.S., President, in the chair.—Mr. W. G. Freeman exhibited a tree of *Hevea brasiliensis* (Parà Rubber), showing the method of tapping adopted in Ceylon.—Dr. R. Braithwaite exhibited specimens of *Hypnum Hochstetteri*, Schimp., collected by him on the Isle of Barra, Outer Hebrides, the only known locality for it in Europe, though found in the Azores and Canary Islands.—The Zoological Secretary communicated a paper, by Prof. T. W. Bridge, on the air-bladder and its connections with the auditory organs in the *Notopteridae*. The anatomy of the air-bladder, auditory organ, and associated parts was described in detail in *Notopterus borneensis*, it being shown that their condition was essentially the same for that species and *N. Pallasii*, and that Cuvier and Valenciennes had erred in regard to the latter by confusing the auditory cæca-containing and cranial cavities. Comparison was instituted with other Teleosteans in which the air-bladder enters into relationship with the occipital region of the skull, and the physiological significance of the facts was discussed.—Mr. F. Chapman read a paper on some new and interesting Foraminifera from the Funafuti Atoll, Ellice Islands. The specimens described, and illustrated by means of lantern-slides, comprised the larger forms found at Funafuti and on coral-reefs generally, together with a new genus (*Haplocatenia*) and eight new species.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 11.

MATHEMATICAL SOCIETY, at 8.—A Problem in Resonance, illustrative of the Mechanical Theory of Selective Absorption of Light: Prof. Lamb, F.R.S.—Elementary Distributions of Plane Stress: J. H. Michell.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Report of the Institution's Visit to Switzerland. The Report will be taken as read, and the discussion will be opened by Mr. Crompton by a Comparison between British and Continental Practice in Electrical Engineering.

FRIDAY, JANUARY 12.

ROYAL ASTRONOMICAL SOCIETY, at 8.—Note on the Variable Star η Argûs: Colonel E. E. Markwick.—Observations of Meteors, November, 1899: Royal Alfred Observatory, Mauritius.—Tables for Facilitating the Calculation of the Radius Vector and True Anomaly for Orbits of any Eccentricities: W. S. Aldis.—Note on the Physical Constitution of the Lunar Surface: George Forbes.—The Determination of Selenographic Positions and the Measurement of Lunar Photographs: S. A. Saunder.——*Probable Paper*: On the Unpublished Observations made with the Transit Instrument and Quadrants at the Radcliffe Observatory, Oxford, between the Years 1774 and 1838: Prof. A. A. Rambaut.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Theory of Structures and Strength of Materials: Prof. T. Claxton Fidler.

MALACOLOGICAL SOCIETY, at 8.—On some Recent Gastropods referred to the Family Turritellidæ and their Supposed Relationship to the Murchisoniidæ: Miss Jane Donald.—On the Anatomy of *Turritella communis*: W. Randles.—Note on *Strombus belutschiensis*, Melvill: E. A. Smith.—Descriptions of New Land Shells from Costa Rica, South and Central America: S. I. DaCosta.—On some Forms of *Cypraea* Mrs. A. F. Kenyon.

MONDAY, JANUARY 15.

VICTORIA INSTITUTE, at 4.30.—Notes on Oriental Congress, Rome, 1899 Theophilus G. Pinches.

TUESDAY, JANUARY 16.

ROYAL INSTITUTION, at 3.—Structure and Classification of Fishes: Prof E. Ray Lankester, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Papers to be further discussed:* The Purification of Water after its Use in Manufactories: Reginald A. Tatton.—Experiments on the Purification of Waste Water from Factories: W. O. E. Meade-King.——*And, time permitting, Paper to be read:* Swing-Bridges over the River Weaver at Northwich: J. A. Saner.

ROYAL STATISTICAL SOCIETY, at 5.

ROYAL PHOTOGRAPHIC SOCIETY, at 8.—Screen Gears for Half Tone: W. Gamble.

WEDNESDAY, JANUARY 17.

SOCIETY OF ARTS, at 8.—Ventilation without Draughts: Arthur Rigg.

ROYAL METEOROLOGICAL SOCIETY, at 7.45.—Annual General Meeting.—Address on "A New Discussion of the Greenwich Meteorological Observations, 1848–1898": F. Campbell Bayard.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Annual Address by the President.

ENTOMOLOGICAL SOCIETY, at 8.—Annual Meeting.—Address by the President, Mr. George Henry Verrall.

THURSDAY, JANUARY 18.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Upon the Development of the Enamel in certain Osseous Fish: C. S. Tomes, F.R.S.—Further Observations on "Nitragin" and on the Nature and Functions of the Nodules of Leguminous Plants: Miss Maria Dawson.—On the Innervation of Antagonistic Muscles, Sixth Note: Prof. Sherrington, F.R.S.—On the Behaviour of the Becquerel and Röntgen Rays in a Magnetic Field: Hon. R. J. Strutt.—On an Experimental Investigation of the Thermo-dynamical Properties of Superheated Steam by Prof. Osborne Reynolds' Method: J. H. Grindley.

ROYAL INSTITUTION, at 3.—The Senses of Primitive Man: Dr. W. H. R. Rivers.

SOCIETY OF ARTS (Indian Section), at 4.30.—Our Work in India in the Nineteenth Century: Sir William Lee-Warner, K.C.S.I.

LINNEAN SOCIETY, at 8.—On the Existence of Nasal Secretory Sacs and of a Nasopharyngeal Communication in the Teleostei: H. M. Kyle.—On the Origin of the Basidiomycetes: George Massee.

CHEMICAL SOCIETY, at 8.—Nitrogen Halogen Compounds: Julius Steiglitz and E. E. Slosson.—Chlorine Derivatives of Pyridine. Part V. Synthesis of αα′-Dichlorpyridine and Constitution of Citrazinic Acid: W. J. Sell and F. W. Dootson.—Action of Fuming Nitric Acid on α-Dibromocamphor: Dr. A. Lapworth and E. M. Chapman.—Electrolysis of Nitrogen Hydrides and of Hydroxylamine: Dr. E. C. Szarvasy.

FRIDAY, JANUARY 19.

ROYAL INSTITUTION, at 9.—Flight: Lord Rayleigh.

EPIDEMIOLOGICAL SOCIETY, at 8.30.

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